OPERATING & SERVICE INSTRUCTIONS FOR

AX300-I

PORTABLE OXYGEN ANALYZER

P/N M75708
07/26/03
REV 0

CE 0086

TYPE B EQUIPMENT: Equipment providing a particular degree of protection against electric shock, particularly regarding—

- Allowable LEAKAGE CURRENT
- Reliability of the protective earth connection (if present).

Copyright © 2002 Teledyne Analytical Instruments
All Rights Reserved

No part of this manual may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any other language or computer language in whole or in part, in any form or by any means, whether it be electronic, mechanical, optical, manual, or otherwise, without prior written consent of Teledyne Instruments, Analytical Instruments, 16830 Chestnut Street, City of Industry, CA 91749-1580

FCC Statement

This equipment generates and uses radio frequency energy, and if not installed and used in strict accordance with the manufacturer's instruction manual, may cause interference to radio and TV communications. It has been type-tested and certified to comply with the limits for a Class A, and exceeds limits for a Class B, computing device pursuant to Subpart J of FCC Rules, which are designed to provide reasonable protection against such interference when installed in a commercial and residential environment. Operation of this equipment in a residential area may cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Note: The above statement is required by the FCC for any device that incorporates microprocessors.

Warranty

Teledyne warrants that the goods are free from defects of material and of construction for a period of 2 years from the date of shipment from Teledyne. The Class R-17MED Micro-Fuel Cell is warranted for two years from the date of shipment from Teledyne. The liability of Teledyne if any, shall be limited solely to the replacement and repair of the goods and shall not include shipping costs or other incidental damages as defined in Section 2-715 of the U.S. Uniform Commercial Code.

This warranty is null and void if any goods are subjected to misuse, negligence, accident, or repairs other than those performed by Teledyne or an authorized service center.

CAUTION: FEDERAL LAW RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN.

About This Manual

The AX300-I Operator's Manual provides both introductory and detailed information for configuring and operating these instruments. The manual takes you from the time you unpack the instrument until you complete the first gas analysis. The bulk of the manual contains operating procedures and information. There are also cautions, warnings, and guidelines to ensure that your analyzer operates normally and to its full potential. A troubleshooting section is available to assist you with common problems and a complete product specifications and spare parts list is included as an appendix.

- **Chapter 1:** An introduction to the analyzer and its components, features and applications.
- **Chapter 2:** Step-by-step set-up procedures and information.
- **Chapter 3:** A guide for daily operational maintenance and troubleshooting.
- **Appendix:** Specifications and available spare part options for the analyzer, and detailed application considerations to aid in troubleshooting, etc.

How To Use This Manual

This manual is designed to walk you through the initial set-up of the AX300 Portable Oxygen Analyzer. After you have used it to initially install your analyzer, it becomes a quick reference guide to help you with specific questions or operating problems.

Before you turning on the instrument, you are advised to read the safety information on the next few pages and the information found in Chapters 1 and 2. These chapters acquaint the user with the instruments use and operation before placing it into operation.

Safety Messages

Your safety and the safety of others are very important. Please carefully read the following safety messages.

Safety message are indented to alert the user of potential hazards. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and on the instrument. The definition of these symbols is described below:

CAUTION: Refer to the instructions for details on the specific danger. These caution symbols warn of specific procedures, which if not followed could cause bodily Injury, and/or damage the instrument.

WARNING: This symbol is use to alert the operator of a condition that could cause bodily harm.

NOTE: Additional information and comments regarding a specific component or procedure are highlighted in the form of a note.

CAUTION: THE ANALYZER SHOULD ONLY BE USED FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

Table of Contents

Safety Messages iv

List of Figures vii

List of Tables viii

Introduction 9

1.1 Applicable Standards 10
1.2 Features 10
1.3 Options 11
1.4 Applications 12
1.5 Theory of Operation 12
1.5.1 Sensor 12
1.5.2 Signal Processing 13

Operation 15

2.1 Setup 15
2.1.1 Sensor Installation or Replacement 16
2.1.2 Mounting 18
2.1.2.1 V-Mount Adapter Installation 18
2.1.2.2 Universal Mounting Clamp Installation 18
2.1.3 Battery Installation 19
2.1.4 Calibration 20
2.1.5 Output 0-1 VDC or RS232 22
2.2 Use 24
2.2.1 Procedure 24
2.3 Gas Sampling 25
2.3.1 Humidity 25
2.3.2 Temperature 25

2.3.3 Pressure 26
2.3.4 Discrepancy in Readings 26
2.3.5 Anesthetic Gases 27
2.3.5.1 Gases That Induce Reading Error 27
2.3.5.2 Care After Use in Nitrous Oxide 28
2.3.6 Cleaning 29
2.4 Do's and Don'ts 30
Service Manual 33
3.1 General Service Information 33
3.2 Overall Maintenance 33
3.3 Battery Maintenance 33
3.4 Sensor Maintenance 34
3.5 Calibration 34
3.6 Gas Sampling 35
3.6.1 Humidity 35
3.6.2 Temperature 35
3.6.3 Pressure 35
3.6.4 Discrepancy in Readings 36
3.6.5 Anesthetic Gases 37
3.6.5.1 Gases That Induce Reading Error 37
3.6.5.2 Care After Use in Nitrous Oxide 38
3.7 Troubleshooting 38
3.8 Watchdog 41
3.9 Other Problems with the Instrument 43
3.10 Return Authorization for Service 44
Appendix 45
A.1 Specifications 45
A.2 Spare Parts List 46
A.3 Optional Accessories 46
Index 49

List of Figures

Figure 1-1: AX300-I Front View 9
Figure 2-1: Installing the R17MED Sensor 16
Figure 2-2: Sensor Cable Connection to Analyzer 17
Figure 2-3: Mounting the Sensor in the Tee Adapter 17
Figure 2-4: V-Mount Adapter Installation 18
Figure 2-5: Brass Insert for Universal Mounting Clamp 18
Figure 2-6: Installing Batteries 19
Figure 2-8: 0-1 VDC or RS 232 Digital Output Port 23

List of Tables

Table 2-1: Oxygen Reading Error in a Mixture of Anesthetic Gas . 28
Table 3-1: Oxygen Reading Error in a Mixture of Anesthetic Gas . 37
Table 3-2 Troubleshooting 39
Table 3-3 Error Codes 42

Introduction

The Teledyne Analytical Instruments AX300-I Oxygen Analyzer here after referred to as AX300-I is a portable instrument that provides fast and accurate oxygen analysis. These instruments are designed to analyzer up to 100% oxygen concentration in medical gas mixtures. Because they are microprocessor-based, the AX300-I analyzers have a unique combination of features that make them very easy to use. The operator interface is accomplished through a series of buttons located conveniently on the front face of the instrument. The AX300 is shown in Figure 1-1.

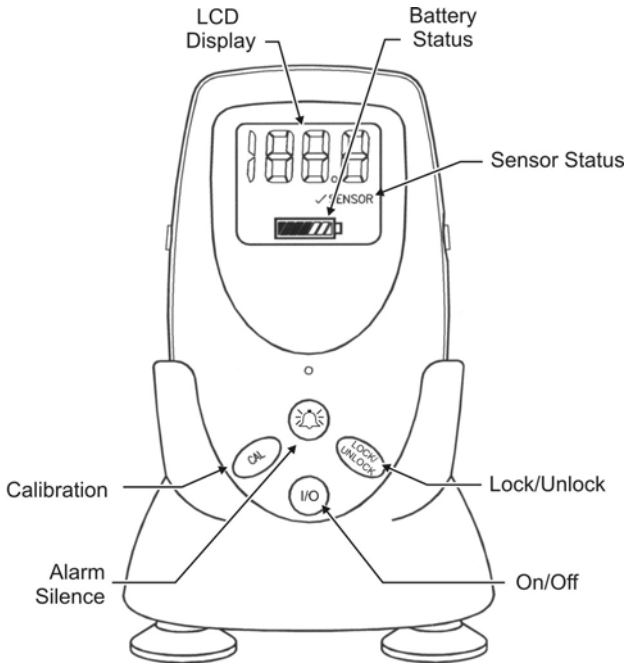

Figure 1-1: AX300-I Front View

The LCD display consists of up to 3.5 characters plus a decimal point indicator capable of displaying up to 105%. (See Section 1.3 Options for alternate display configuration). An integral battery life indicator is displayed continuously on the AX300-I.

The instrument is powered by three AA alkaline batteries and is designed to operate for 2000 hours in non-alarm state.

Oxygen analysis is linear across the single range of 0-100% using Teledyne's class R17MED oxygen sensor. A unique sensor failure alarm is incorporated which warns the user if the sensor signal is lost or low. When this occurs, the √ SENSOR display flashes. The alarm buzzer can be silenced by pressing the ALARM SILENCE key (🔔) or pressing the unlock key.

1.1 Applicable Standards

The AX300-I is built to meet or exceed regulatory and industry standards for use as a medical device. These instruments are designed, built and tested with the following applicable standards:

- ASTM F 1462: Specifications for Oxygen Analyzers
- ASTM F 1463: Specifications for Alarm Signals
- ISO 7767: Oxygen Analyzers for Analyzing patient Breathing Mixtures
- ISO 9703-1: Anesthesia and Respiratory Care Alarm Signals Part 1
- ISO 9703-2: Anesthesia and Respiratory Care Alarm Signals Part 2
- EN/IEC 60601-1-2: Medical Electrical Equipment—Part 1 General Requirements for Safety. Electromagnetic Compatibility Requirements and Test
- MIL-STD-810E: Environmental Test Methods
- EN/IEC 60601-1: Medical Electrical Equipment-General Requirements for Safety

1.2 Features

The AX300-I is a compact, versatile instrument capable of rapidly measuring the oxygen content of an atmosphere or environment accurately to ±2% over the range 0-100% oxygen. The following features are standard on the AX300-I:

- Large easy to read 3 1/2 digit LCD display (see options)
- Automatic LCD back lighting upon key press

- Microprocessor controlled
- Sensor fail/disconnect alarm indicator (audible and visual)
- Alarm silence button
- 2000 operating hours from 3 AA alkaline batteries
- Battery status indicator
- Stand for upright tabletop deployment
- Hardware for pole clamping and V block support
- Rugged high impact ABS construction
- Splash resistant case.
- Long life (36 months in air) class R17MED sensor
- 0-1 VDC digital output (optional RS-232)
- FDA approved and cleared for CSA/CE marking

1.3 Options

The following instrument options are available for the AX 300-I analyzer:

- A-Option—3-digit LCD display instead of 3 1/2 digit
- B-Option—RS 232 digital output instead of 0-1VDC

Note: Contact the factory for retrofitting an existing instrument for 3 digit LCD display. For RS-232 reconfiguration, see Section 2.1.5.

In addition to the above instrument configuration options, the following optional equipment is available for your instrument:

- Universal Pole Mounting Clamp (P/N CP 2343)
- V-Mount Pole Clamp (P/N CP 2344)
- V-Mount Wall Adapter P/N B 647)
- 0-1 VDC Interface Cable (P/NB-75554)
- RS 232 Interface Cable (P/N B-75555)

1.4 Applications

The AX300-I analyzers is intended for spot checking concentration of oxygen in a gas mixtures used in medical applications such as Anesthesia, Respiratory therapy and is intended for adult, pediatric and Neonatal populations.

These instruments may be used in verifying oxygen concentrations in gas mixtures used in:

- Anesthesia
- Respiratory Therapy
- Neonatal Care

1.5 Theory of Operation

The AX300-I analyzer can be divided into two major functional groups:

- R17MED Oxygen Sensor
- Signal Processing

The analyzer uses Teledyne Analytical Instruments Patented R17MED oxygen sensor. The millivolt output signal from the sensor is fed into the electronic signal processor, where it is used to calculate the oxygen gas concentration and display it on the LCD screen. There is no concentration alarm in the AX300-I analyzer however a unique sensor fail/disconnect alarm is incorporated to warn the user of a sensor problem. The√ SENSOR indicator is illuminated on the LCD and the audible and visual alarms are activated whenever a fault is detected.

1.5.1 Sensor

The AX300-I uses the Teledyne Class R17MED disposable oxygen sensor. The sensor is made up of a sensing cathode and anode (fuel) immersed in electrolyte and packaged in a small plastic container. Oxygen entering the sensor reacts with the anode and a proportional current is collected at the sensing cathode, which is sent to the electronics where it is converted into a digital signal and displayed on the LCD Screen.

Attached to the R17MED sensor is a removable plastic diverter. This diverter is used to facilitate the transport of gas mixtures through

the sensor. The diverter, packaged separately when shipped, is necessary when the tee adapter is used to sample gas flowing through a tube.

The diverter is not necessary and should not be used when the sensor is placed directly in a chamber, or when the sensor is used in confined volume analysis, such as incubators and inhalation tents.

CAUTION: THE R17MED SENSOR CONTIANS A CAUSTIC ELECTROLYTE AND LEAD. DO NOT TRY TO OPEN THE SENSOR ASSEMBLY. CHECK THE SENSOR REGULARLY FOR LEAKS. IF THE SENSOR IS LEAKING, REPLACE IT. DO NOT TRY TO REPAIR IT. CONTACT TELEDYNE FOR THE MATERIAL SAFETY DATA SHEET RELATED TO HANDLING AND DISPOSAL.

CAUTION: REMOVE AND SAVE THE DIVERTER WHEN THE SENSOR IS USED IN CONFINED VOLUME APPLICATIONS.

1.5.2 Signal Processing

The electrical voltage developed in the sensor is sent to the electronics. Processing includes amplification, conversion to digits, and comparison to alarm set points if appropriate. Using a microprocessor allows for easier setting of alarms, automatic calibration, and self-diagnosis.

The oxygen level is calculated and then displayed on the liquid crystal display (LCD) on the front panel.

The audio alarm is triggered during a sensor disconnect alarm condition. Pressing the ALARM SILENCE key (🔔) will provide an audible alarm override.

BLANK

Operation

Note: Upon receipt, INSPECT THE ENTIRE UNIT FOR DAMAGE. Check the unit and all included accessories for broken or loose parts. If damaged, DO NOT USE. Notify the shipper, and consult Teledyne Analytical Instruments.

Note: This equipment is internally powered using 3 AA batteries.

CAUTION: THE AX300-I, OXYGEN SENSOR AND ASSOCIATED HARDWARE ARE NON-STERILE DEVICES. DO NOT AUTOCLAVE THE INSTRUMENT OR SENSOR, AS THIS WILL DAMAGE THE EQUIPMENT.

2.1 Setup

The AX300-I Portable Oxygen Analyzer is suitable for use in many medical applications. The unit is equipped with a stand and can be used on a tabletop or wall mounted using mounting bracket. An optional pole mount clamp is also available.

To set up and use your AX300-I analyzer:

1. Install the sensor.
2. Install the batteries.
3. Calibrate the unit.

The control keys are designed for easy operation. A LOCK/UNLOCK key has been supplied to prevent accidental changes to critical settings. This eliminates unwanted changes in calibration or alarm settings from accidental touching or bumping of the keys. To further reduce the possibly of incorrect adjustments at least two keys must be pressed in order to modify a critical calibration set point value.

Note: The ALARM SILENCE (🔔) key continues to operate normally when the lock feature is activated.

2.1.1 Sensor Installation or Replacement

Note: The R17MED oxygen sensor must be installed before the oxygen analyzer/analyzer can be operated

Remove the new sensor from its protective bag. Inspect the sensor for damage or electrolyte leakage. If the sensor is damaged, obtain a replacement. Do not use the defective sensor as it may damage the unit.

WARNING: THE SENSOR ELECTROLYTE IS CAUSTIC. DO NOT LET IT COME IN CONTACT WITH SKIN. IF IT DOES, FLUSH AFFECTED AREA WITH WATER. DO NOT ATTEMPT TO OPEN OR REPAIR THE SENSOR.

WARNING: THE SENSOR ALSO CONTAINS LEAD. LEAKING OR EXHAUSTED SENSORS SHOULD BE HANDLED AND DISPOSED OF IN ACCORDANCE WITH LOCAL REGULATIONS. CONTACT TELEDYNE FOR THE MATERIAL SAFETY DATA SHEET

2. Plug one end of the coiled cable into the jack receptacle on the back end of the R17MED sensor and secure in place with the capture nut located at the base of the connector. See Figure 2-1.

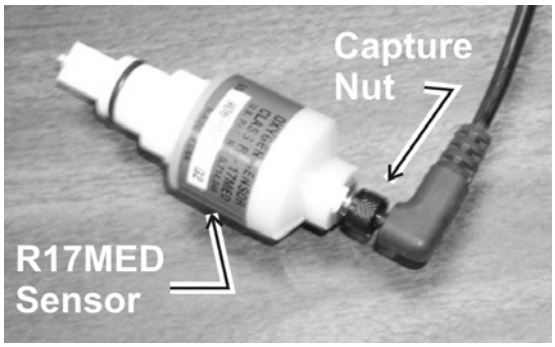

Figure 2-1: Installing the R17MED Sensor

3. Plug the other end of the coiled cable into the receptacle located on the right side of the unit and secure it in place using the capture nut. See Figure 2-2.

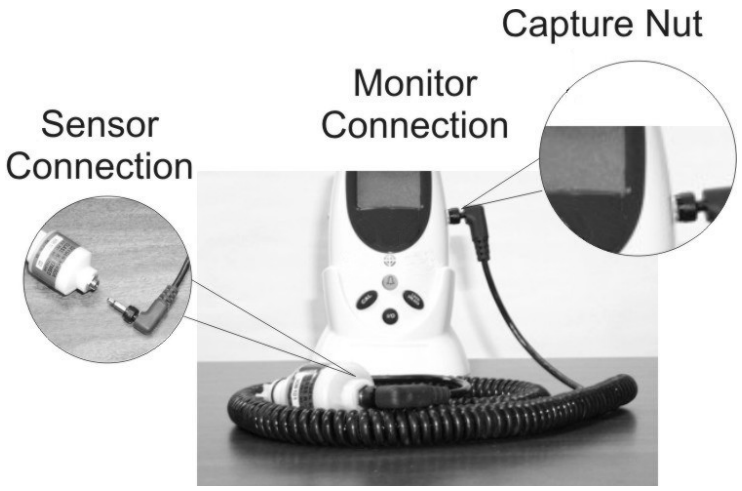

Figure 2-2: Sensor Cable Connection to Analyzer

Note: When the AX300-I instrument is used for diffusion sampling (i.e., incubators, tents, etc.), the plastic flow diverter must be removed from the R17MED sensor. If the sensor is used in breathing circuits, etc, the diverter must be used as shown in Figure 2-3.

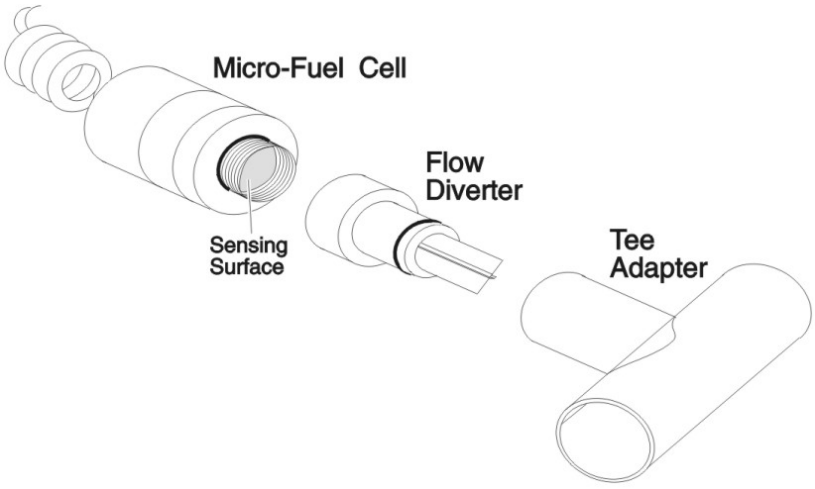

Figure 2-3: Mounting the Sensor in the Tee Adapter

2.1.2 Mounting

The AX300-I can be mounted in several ways depending on the optional equipment ordered at the time of purchase. See Section 1.3.

2.1.2.1 V-MOUNT ADAPTER INSTALLATION

The V-Mount Adapter consists of a matching plastic plate with integral V-grooves that attach to the rear of the instrument.

To install V-Mount Adapter remove battery compartment door by prying up the hinged latch at the bottom of the cover, then slide the adapter plate into grooves provided in rear case. Replace the battery compartment door and secure door latch. See Figure 2-4.

Note: The door latch is a tight fit onto the battery cover. Use a coin to gently pry up the latch.

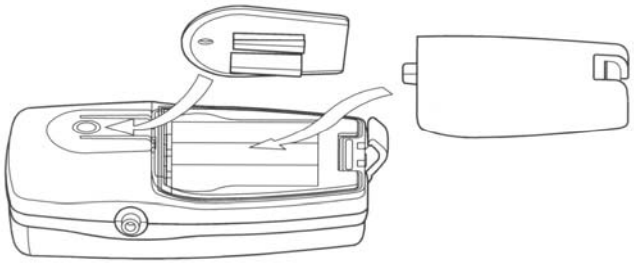

Figure 2-4: V-Mount Adapter Installation

2.1.2.2 UNIVERSAL MOUNTING CLAMP INSTALLATION

The Universal Mounting Clamp is supplied with a 1/4-20 screw for securing the clamp to the rear of the instrument. A threaded brass insert is installed on the back of the instrument for this purpose. See Figure 2-5.

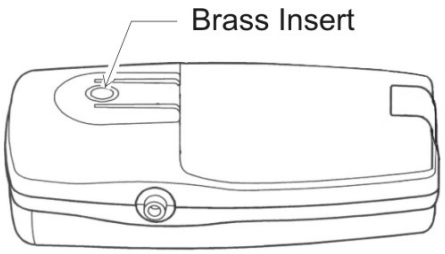

Figure 2-5: Brass Insert for Universal Mounting Clamp

2.1.3 Battery Installation

Note: Three "AA" alkaline batteries must be installed in the unit before the analyzer will operate. ***The unit must be recalibrated whenever new batteries are installed****.*

To install the batteries:

1. Turn the unit off (if it is on).
2. Hold the instrument face down in the palm of your hand. Use a coin to pry up the latch that secures the battery compartment door. Remove the battery compartment door.

CAUTION: IMPROPER INSTALLATION OF THE BATTERIES MAY RESULT IN DAMAGE TO THE UNIT AND BATTERIES.

Note: Use alkaline batteries only. Other battery types will produce erroneous battery test readings.

3. Install 3 "AA" alkaline batteries into the holder as shown in Figure 2-6. Each battery has its own slot. To insure proper polarity, place the bottom (flat) or negative end of the battery in the end of the holder marked "–". Place the top (button) or positive end of the battery in the end of the holder marked "+". Do this for each battery.

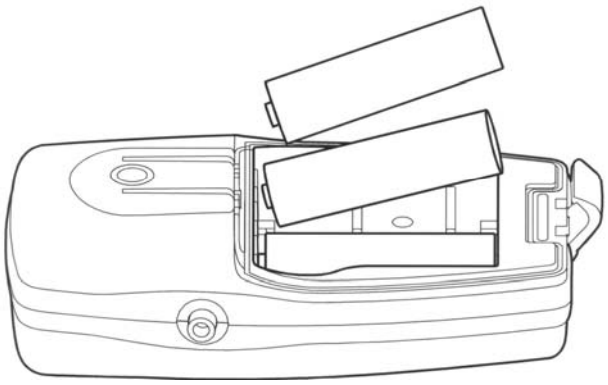

Figure 2-6: Installing Batteries

4. Re-install the battery compartment door. When the unit is first turned on the display will momentarily display all LCD segments. During this period diagnostic tests are being conducted to insure the circuits are functioning correctly. The unit will activate the audible and visual alarms for about 1 second. The LCD will flash continuously indicating the unit is in the unlocked position ready for calibration.

Note: When batteries are first installed or power is lost for any reason the instrument defaults to the calibration mode. All keys except the CAL and ON/OFF (I/O) keys are inoperable until a successful calibration is achieved.

5. Note the battery display located below the oxygen readout display. It continuously shows a bar graph of the remaining life to the batteries. In the case of fresh batteries, it should illuminate all 5 segments from the left to the right end of the bar. The bar graph indicator is on continuously whenever the instrument is powered on.

2.1.4 Calibration

The AX300-I should be calibrated before each use and every 8 hours to maintain accuracy.

Whenever new batteries are installed or removed for any reason, the oxygen analyzer defaults to the calibration mode with the LCD display flashing 00.0. Only the CAL and ON/OFF (I/O) keys are functional at this point.

Note: For first time and for routine maintenance calibrations, make sure the sensor and sensor cable are installed correctly before attempting to calibrate the instrument

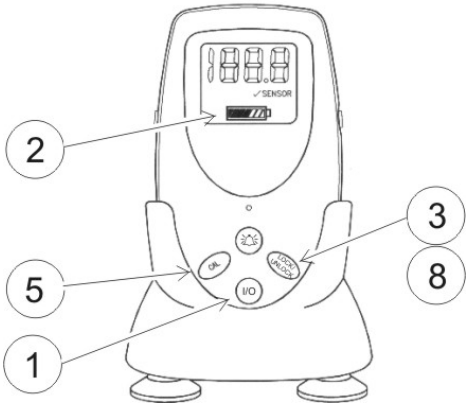

Figure 2-7: Calibration Sequence

To calibrate the instrument (See Figure 2-7):

1. Turn the unit on by pressing the ON/OFF (I/O) key.

2. Check the battery status via the bar graph.
3. If the LCD is not flashing, press the LOCK/UNLOCK key to unlock the keys. LCD will flash indicating changes can be made to the settings. If the batteries have just been installed the LCD will flash 00.0
4. As with most oxygen analyzer(s) the highest level of accuracy is achieved when calibration is conducted using 100% oxygen. After installing the flow diverter as noted in Section 2.1.1, insert the sensor into the plastic tee and connect to a supply of pure dry oxygen flowing at 1-2 liters per minute.

Note: An accessory calibration assembly (P/N C53790) is available from Teledyne for use with the R17MED sensor

5. Wait about 20 seconds to insure the sample line is completely purged with the calibration gas. Press the CAL key. The LCD will count down from 9 to 0. During this time the microprocessor is measuring the sensor output to determine the gas concentration and selects the calibration range i.e. 100% or 20.9%. When the calibration is complete the LCD will display the gas value. Press the LOCK/UNLOCK key to save the calibration data.

Note: The AX300-I can only be calibrated using 100% oxygen or room air 20.9%. Improper calibration or use of other gas concentrations will activate the √SENSOR indicator. To repeat the calibration press the LOCK/UNLOCK key and press the CAL key.

6. Remove the sensor from the oxygen supply and confirm the LCD reads less than 22% in room air. It is not necessary for it to read exactly 20.9%.
7. It is important to perform the calibration carefully and thoroughly, using calibration gases that are free from contaminates. Wait for a stable reading before locking in calibration point. The accuracy of the instrument is only as good as the procedure used to calibrate it.

Note: A single point air calibration is not recommended unless the sensor can be exposed to a known source of fresh outdoor air. Hospital room air is often enriched with excess oxygen, which will introduce errors into the calibration.

Air calibration should only be used for analyzing oxygen levels between 21% and 40% and should never be used where a high degree of accuracy is needed.

Note: Never calibrate the unit in humidified gas, as water vapor makes the oxygen concentration appear lower than it really is. See Section 2.3.1: Humidity.

CAUTION: DO NOT ADJUST THE CALIBRATION SETTINGS IN AIR AFTER THE 100% CALIBRATION, AS THIS WILL CANCEL THE MORE ACCURATE 100% CALIBRATION. THE 100% CALIBRATION MAY BE REPEATED AS MANY TIMES AS DESIRED.

8. Press the LOCK/UNLOCK key to hold settings. The unit is now ready for use.

2.1.5 Output 0-1 VDC or RS232

The AX300-I Portable Oxygen Analyzer provides signal outputs for use with recorders and computers. These instruments are supplied standard with a 0-1 VDC output. An optional 0-1 VDC Interface Cable (P/N B-75554) is available from Teledyne for this purpose.

To connect the analyzer to an analog recording device:

1. Insert one end of the interface cable into the output port on the side of the instrument. See Figure 2-8.
2. Insert the other end into the analog recorder device. Make sure the device is equipped to handle a 0-1 VDC signal.

When properly calibrated, the output signal generated by the analyzer is linear and proportional to the oxygen concentration.

If you requested Option-B (RS 232 digital output) at the time of purchase, a digital RS 232 signal is output from the output port shown in Figure 2-8. Use the optional RS 232 Interface Cable (P/N B-75555) available from Teledyne for connection to a standard RS 232 port on a computer or other suitably equipped digital device.

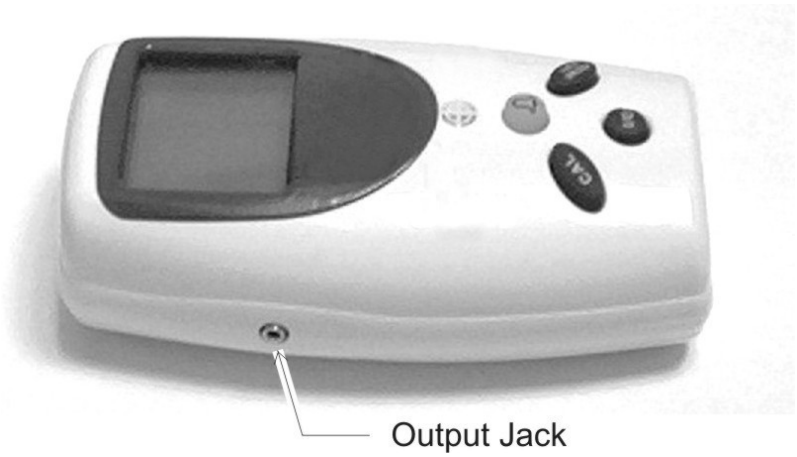

Figure 2-8: 0-1 VDC or RS 232 Digital Output Port

If your instrument is set for analog (0-1 VDC) output, you can reconfigure it to use the digital output by changing a jumper on the internal PC board.

To activate the digital output:

1. Remove the batteries and remove the five screws that hold the case together.
2. Remove the rear case section leaving the PCB in the front half of the case.
3. Remove jumper at position JP3 and reinstall it at position JP7.
4. Replace the rear cover and secure in place with five screws. Install the batteries and recalibrate per Section 2.1.3.

CAUTION: RECORDER/RS232 OUTPUT SIGNAL SHOULD ONLY BE CONNECTED TO AN EN60601-1/IEC60606-1 APPROVED DEVICE.

To reconfigure the analyzer from a digital (RS 232) output to analog (0-1 VDC) output, use the same procedure except in step 3 remove the jumper from JP7 and replace it at JP3.

2.2 Use

2.2.1 Procedure

Note: Prior to use, always test the batteries. Also check calibration, the sensor for leaks and damage, and the alarm settings.

The AX300-I instrument can be used to measure a gas mixture for oxygen in two basic modes:

- In the inhalation side of breathing circuit ahead of antibacterial filters, humidifiers and medicating devices or other instances where gases are flowing to a patient in breathing circuits.
- In confined volumes such as incubators or tents.

When analyzing for oxygen in breathing circuits, the flow diverter must be used. The diverter should be screwed onto the threaded front end of the R17MED sensor. A tee adapter (plastic, P/N A268, or metal, P/N A283) should be placed into the circuit, and the above sensor assembly plugged into the tee adapter. See Figure 2-3.

CAUTION: CHECK THE BREATHING CIRCUIT FOR LEAKS. BE CERTAIN THAT THE CIRCUIT DOWNSTREAM OF THE SENSOR DOES NOT PRODUCE ANY BACKPRESSURE OR RESTRICTION TO FLOW. ERRORS IN READINGS WILL RESULT IF THIS IS NOT FOLLOWED.

THE OXYGEN SENSOR IS A NON-STERILE DEVICE AND SHOULD BE USED IN CONJUCTION WITH AN ANTIBACTERIAL FILTER. ALWAYS INSTALL THE SENSOR ON THE INSPIRED LINE AHEAD OF FILTERS, HUMIDIFIERS AND MEDICATING DEVICES. NEVER INSTALL THE SENSOR IN A LOCATION THAT WILL EXPOSE THE SENSOR TO PATIENTS EXHALED BREATH OR SECRETIONS UNLESS YOU INTEND TO DISPOSE OF THE SENSOR AND FLOW ADAPTER AFTER USE.

When analyzing for oxygen in confined volumes such as incubators, hoods, etc., the flow diverter must be removed from the

R17MED sensor so that it does not interfere with the rapid exchange of gases to and from the sensing surface of the sensor.

CAUTION: FAILURE TO REMOVE THE DIVERTER IN THESE APPLICATION AREAS WILL RESULT IN A MARKED LOWERING OF THE RESPONSE TIME OF THE SENSOR.

The R17MED sensor can be placed or hung inside incubators, tents, etc. When it is necessary to thread the cable through a small hole in order to gain access to the inside of a chamber, the cable should be disconnected at the sensor, threaded through the hole, and reconnected inside the chamber.

The LOCK/UNLOCK key can be used to lock out any accidental interference to the front panel keys. The LOCK/UNLOCK key acts as a toggle, pressing LOCK/UNLOCK once renders inactive all keys except the ALARM SILENCE (🔔) key. Pressing LOCK/UNLOCK a second time unlocks the keypad.

2.3 Gas Sampling

2.3.1 Humidity

Humidity does not directly affect the accuracy of the sensor's measurement. However, when a nebulizer or other device is used to increase moisture levels in gas mixtures, the moisture actually dilutes the mixture. This dilution effect decreases the oxygen concentration.

For example, if an 80% oxygen gas mixture is humidified to saturation at room temperature, the resulting gas mixture will contain only 77.5% oxygen. Your portable oxygen analyzer accurately measures decreases in the oxygen concentration due to the dilution effects of moisture added to gas mixtures.

As with all oxygen sensors, excessive condensation on the sensing surface of the R17MED will block the diffusion of oxygen to the sensor, rendering it inoperative. We recommend installing the sensor on the dry side of the breathing circuit at all times.

2.3.2 Temperature

The R17MED oxygen sensor adjusts for ambient temperature changes in the range of 0–40°C (32–106°F). Since the thermistor that compensates for these changes is located in the rear of the sensor assembly, it is

important that gas mixtures, flowing over the front of the sensor, be at room temperature. Reading errors may occur if hot gases from a heated humidifier are directed past a sensor teed into a breathing circuit.

A small thermal tracking error may be encountered in application areas where the entire sensor assembly is placed in the gas mixture to be analyzed (e.g., incubators). Holding the sensor in your hand for more than a few minutes can also affect the temperature tracking which appears as a slow drift on the LCD. No adjustments should be made during this period since this error will be eliminated when both the thermistor and sensing electrode have had sufficient time to come to thermal equilibrium. This can take up to 2 hours.

2.3.3 Pressure

Virtually all gas sensors and analyzers measure the partial pressure, not the percentage, of the gas that they sense. The only time that these instruments can accurately read percentages is when the total pressure does not vary over time between calibrations and use. For this reason it is important to calibrate the AX300-I oxygen sensor at regular intervals. It is recommended that the unit be calibrated prior to each use or every 8 hours.

When the sensor is connected to a ventilator circuit, the alternating "breathing" pressure cycles generated by the ventilator will be sensed as an increase in the oxygen percentage (especially if the sensor is fast enough to sense the changes, as is the R17MED). In reality, the percentage of oxygen is not changing; it is the total pressure that is increasing producing a corresponding increase in the partial pressure of oxygen. A hundred centimeter of water pressure pulse will produce a 0.11 atmosphere, or an 11% increase in the total and therefore partial pressure of oxygen. Assuming that the sensor is fast enough to track this pressure pulse, an un-pressurized reading of 50% oxygen will increase to 55.3% if the sensor is subjected to a pressure cycle of 100cm H_2O. The reading will rise proportionally less for smaller pressures.

2.3.4 Discrepancy in Readings

The AX300-I instrument should be used to measure the oxygen concentration exiting another oxygen mixing device or life support system (i.e., a blender, incubator or anesthesia machine). The information obtained from the AX300-I should never be used to adjust a life-support system, but should only be used as an indication that the life support system or device may require service and/or calibration.

When a discrepancy in oxygen readings is detected, the oxygen analyzers readings should be verified by checking the AX300-I battery condition and calibration using 100% oxygen. If the analyzer can be calibrated, the unit can be assumed to be in good working order and capable of providing readings to specification. If, after reinstalling the unit, the discrepancy in oxygen readings persists, the problem is most likely elsewhere (i.e., flow blockage, primary device error, etc.). Further investigation should be made until the discrepancy in readings is resolved. The troubleshooting section of this manual may provide additional assistance in locating the problem.

Note: The MSDS on this material is available upon request through the Teledyne Environmental, Health and Safety Coordinator. Contact at (626) 934-1592

2.3.5 Anesthetic Gases

2.3.5.1 Gases That Induce Reading Error

When using the R17MED sensor in the presence of anesthetic gases such as Halothane, the oxygen reading may fall (see Table below). The magnitude of this error will depend upon the level of oxygen and the duration of exposure.

The anesthetic agents listed in the following table (Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane) were vaporized into a stream of 30% oxygen / 70% nitrous oxide, and the resulting drops in oxygen level after an exposure of approximately two hours were noted.

Exposures in excess of two hours may produce slightly greater errors. The errors listed are typical for all oxygen sensors such as the R17MED. Exposing the sensor to air or gases that do not contain anesthetic agents for a period of time equal to or greater than the exposure interval will eliminate the reading error in most cases.

CAUTION: THE AX300-I SHOULD NOT BE USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS SUCH AS DIETHYL ETHER OR CYCLOPROPANE.

CAUTION: THE AX300-I, OXYGEN SENSOR AND ASSOCIATED HARDWARE ARE NON-STERILE DEVICES. DO NOT AUTOCLAVE THE INSTRUMENT OR SENSOR, AS THIS WILL DAMAGE THE EQUIPMENT.

Table 2-1: Oxygen Reading Error in a Mixture of Anesthetic Gas

Gas or Vapor Level (Balance: Mixture of 30% O_2 / 70% N_2O, except where noted)		
Gas or Vapor	**Test Level**	**Oxygen Reading Error**
Helium	50%, balance O_2	0%
Nitrous Oxide	80%, balance O_2	0%
Carbon Dioxide	10%, balance O_2	0%
Halothane	4%	< 1.5% O_2 *
Enflurane	5%	< 1.5% O_2 *
Isoflurane	5%	< 1.5% O_2 *
Sevoflurane	5%	< 1.5% O_2 *
Desflurane	15%	< 1.5% O_2 *

* Errors are approximate and may vary based on exposure times and concentrations.
These performances meet or exceed the requirements of ISO 7767: 1997 (E).

2.3.5.2 CARE AFTER USE IN NITROUS OXIDE

CAUTION: THE R17MED SENSOR SHOULD NOT BE LEFT IN NITROUS OXIDE MIXTURES ANY LONGER THAN ABSOLUTELY NECESSARY.

After exposure to nitrous oxide mixtures, the sensor should be left in 100% oxygen overnight (e.g., left in a breathing circuit that has been flushed with pure oxygen). If this is not practical, when using the tee, remove the plastic flow diverter and leave the sensor in room air. If the oxygen reading continues to drop after each use in nitrous oxide the sensor should be removed from service. If the sensor can no longer be calibrated or if there is any sign of electrolyte leakage, the sensor should be disposed of in accordance with local regulations and the Material Safety Data Sheet (MSDS) available through Teledyne.

2.3.6 Cleaning

The instruction below describes the methods to clean and disinfect the instrument, sensor and its accessories (e.g. diverter, tee adapter).

Instrument

When cleaning or disinfecting the instrument, care must be taken to prevent entry of solutions into the instrument's case.

- Cleaning - The external surfaces of the oxygen sensor and the cable may be cleaned by wiping with a cloth moistened with a mild detergent solution.
- Disinfecting – The diverter and tee adapter may be disinfected by washing with isopropyl alcohol.

Sensor & Cable

- Cleaning – The external surfaces of the oxygen sensor and cable may be cleaned by wiping with a cloth moistened with a mild detergent solution.
- Disinfecting – The diverter and tee adapter may be disinfected by washing them with isopropyl alcohol or Cidex (per manufacturer's instructions). The parts must be thoroughly dry before they are used.
- Sterilizing – The diverter and tee adapter may be sterilized using Cidex, steam or ethylene oxide (per manufacturer's instructions). Due to the varying conditions imposed on the materials during sterilization it is not possible to determine the exact number of times the sterilization processes can be carried out. Therefore, Teledyne recommends that operators carefully examine the diverter and tee adapter after sterilization and prior to use to verify that the item is fit for use. The operator should verify that there are no cracks and tears and the item does not show any indication of material changes or physical damage that may compromise its effective use.

Both diverter and tee adapter should be free of any chemical residue attributable to the sterilization process.

Because of the variability of the cleaning, disinfecting and sterilizing processes, Teledyne cannot provide specific sterilization instructions nor can the sterility of the item be ensured. Therefore, we highly recommend referring to the manufacturer's instructions on the details of method.

2.4 Do's and Don'ts

– DO –

- Read all of the directions before using for the first time.
- Calibrate every 8 hours or before every use.
- Visually inspect the sensor for leakage before each use.
- Calibrate using 100% oxygen and check in air.
- Test batteries regularly and replace when battery indicator shows low battery (no bars remaining)
- Make sure keys are locked by using the LOCK/UNLOCK key feature.
- Keep the unit, sensor and connections dry, or on the dry side of the breathing circuit.
- Recalibrate after replacing the batteries.
- Recalibrate after replacing the sensor.
- Use properly installed alkaline batteries only.
- Make sure the R17MED sensor is properly attached.
- Remove the plastic flow diverter only when using the tee adapter.
- Remove and save the plastic flow diverter when using the sensor in non-flowing applications (incubators, tents, etc.)
- Clean the case with isopropyl alcohol or mild detergent only.

– DON'T –

- Use this analyzer if you suspect any malfunction.
- Use the instrument in the presence of flammable gases.
- Use anything but alkaline batteries.
- Autoclave or freeze the sensor or instrument.
- Open or try to repair a leaking or broken sensor.
- Immerse the unit or sensor in any liquid.
- Pass hot or cold gas mixtures over the sensor.
- Adjust the reading in air after 100% calibration
- Expose the unit to devices that produce high levels of radio, short wave, microwave, x-ray, or high frequency interference.
- Use cleaning agents or liquids in the cable receptacles or around the battery compartment.
- Place the unit itself in a water vapor-saturated environment.
- Expose the LCD to excessive sunlight.
- Expose the unit to a condensing water environment such as a mist tent.

BLANK

Service Manual

3.1 General Service Information

The Teledyne Model AX300-I portable oxygen analyzer is designed to be robust yet compact in size. In order to achieve maximum reliability in a microprocessor-based instrument, a single PC board is used which relies exclusively on surface mount technology. Without access to specialized probes and test equipment, troubleshooting and repair of circuit board components are not feasible. A factory replacement of the entire PC board is more cost effective than a field repair of an individual component.

With the exception of replacing the sensor or batteries there are no user-serviceable components inside the unit. There are no potentiometers or other adjustments to be made within this instrument. If a problem arises with either of these models that cannot be corrected by recalibration, changing the batteries or replacing the sensor as described in this manual, the unit must be sent back to the factory for repair or replacement. See Section 3.10 for instructions on obtaining a Return Merchandise Authorization (RMA) number before sending a unit back to Teledyne for repair.

3.2 Overall Maintenance

The AX300-I instrument requires very little maintenance, other than calibration, checking and changing the batteries and sensor, and cleaning the plastic housing. Occasional cleaning of the plastic surface can be done with isopropyl alcohol. Should any part of the instrument malfunction or fail to perform, the unit should be removed from service. There are no user-serviceable components within the instrument.

3.3 Battery Maintenance

DO: Test batteries regularly. (replace immediately when all 5 bars are missing).

DO: Always use alkaline batteries.

DO: Recalibrate after replacing batteries.

The AX300-I instrument incorporates a bar graph that continuously displays the approximate amount of useful life remaining on the set of installed batteries. Excessive alarm activation will wear down the battery faster than usual. The minimum detectable change in battery voltage corresponds to an increment of about 50 hours, meaning that the battery voltage reading may not change for several hours at a time.

If the analyzer is not used for a period of 30 days or more, the batteries should be removed prior to storage.

3.4 Sensor Maintenance

DO: check the sensor for damage or leaks before use.

DO: recalibrate after replacing the sensor.

DON'T: immerse the R17MED sensor in liquid.

DON'T autoclave the R17MED sensor.

DON'T: open or try to repair the sensor.

Before every use, the sensor, cable and connections should be checked. Check the sensor for leaks and condensation. Check the cable for splitting or cracked insulation. Make sure the connections are tight and dry.

In the event that the sensor has been damaged, consult the Material Safety Data Sheet in the Appendix for handling guidelines.

3.5 Calibration

Incorrect readings can often traced to improper calibration. The AX300-I should be calibrated before each use and every 8 hours to maintain accuracy. It must be calibrated whenever new batteries are installed. Calibration using methods other than described below can lead to improper operation and are discouraged.

Whenever new batteries are installed or removed for any reason, the oxygen analyzer defaults to the calibration mode with the LCD display flashing 00.0. Only the CAL and ON/OFF (I/O) keys are functional at this point.

To calibrate the instrument refer back to Section 2.1.4.

3.6 Gas Sampling

3.6.1 Humidity

Humidity does not directly affect the accuracy of the sensor's measurement. However, when a nebulizer or other device is used to increase moisture levels in gas mixtures, the moisture actually dilutes the mixture. This dilution effect decreases the oxygen concentration.

For example, if an 80% oxygen gas mixture is humidified to saturation at room temperature, the resulting gas mixture will contain only 77.5% oxygen. Your portable oxygen analyzer accurately measures decreases in the oxygen concentration due to the dilution effects of moisture added to gas mixtures.

As with all oxygen sensors, excessive condensation on the sensing surface of the R17MED will block the diffusion of oxygen to the sensor, rendering it inoperative. We recommend installing the sensor on the dry side of the breathing circuit at all times.

3.6.2 Temperature

The R17MED oxygen sensor adjusts for ambient temperature changes in the range of 0–40°C (32–106°F). Since the thermistor that compensates for these changes is located in the rear of the sensor assembly, it is important that gas mixtures, flowing over the front of the sensor, be at room temperature. Reading errors may occur if hot gases from a heated humidifier are directed past a sensor teed into a breathing circuit.

A small thermal tracking error may be encountered in application areas where the entire sensor assembly is placed in the gas mixture to be analyzed (e.g., incubators). Holding the sensor in your hand for more than a few minutes can also affect the temperature tracking which appears as a slow drift on the LCD. No adjustments should be made during this period since this error will be eliminated when both the thermistor and sensing electrode have had sufficient time to come to thermal equilibrium. This can take up to 2 hours.

3.6.3 Pressure

Virtually all gas sensors and analyzers measure the partial pressure, not the percentage, of the gas that they sense. The only time that these

instruments can accurately read percentages is when the total pressure does not vary over time between calibrations and use. For this reason it is important to calibrate the AX300-I oxygen sensor at regular intervals. It is recommended that the unit be calibrated prior to each use or every 8 hours.

When the sensor is connected to a ventilator circuit, the alternating "breathing" pressure cycles generated by the ventilator will be sensed as an increase in the oxygen percentage (especially if the sensor is fast enough to sense the changes, as is the R17MED). In reality, the percentage of oxygen is not changing; it is the total pressure that is increasing producing a corresponding increase in the partial pressure of oxygen. A hundred centimeter of water pressure pulse will produce a 0.11 atmosphere, or an 11% increase in the total and therefore partial pressure of oxygen. Assuming that the sensor is fast enough to track this pressure pulse, an un-pressurized reading of 50% oxygen will increase to 55.3% if the sensor is subjected to a pressure cycle of 100cm H_2O. The reading will rise proportionally less for smaller pressures.

3.6.4 Discrepancy in Readings

The AX300-I instrument should be used to measure the oxygen concentration exiting another oxygen mixing device or life support system (i.e., a blender, incubator or anesthesia machine). The information obtained from the AX300-I should never be used to adjust a life-support system, but should only be used as an indication that the life support system or device may require service and/or calibration.

When a discrepancy in oxygen readings is detected, the oxygen analyzers readings should be verified by checking the AX300-I battery condition and calibration using 100% oxygen. If the analyzer can be calibrated, the unit can be assumed to be in good working order and capable of providing readings to specification. If, after reinstalling the unit, the discrepancy in oxygen readings persists, the problem is most likely elsewhere (i.e., flow blockage, primary device error, etc.). Further investigation should be made until the discrepancy in readings is resolved. The troubleshooting section of this manual may provide additional assistance in locating the problem.

Note: The MSDS on this material is available upon request through the Teledyne Environmental, Health and Safety Coordinator. Contact at (626) 934-1592

3.6.5 Anesthetic Gases

3.6.5.1 GASES THAT INDUCE READING ERROR

When using the R17MED sensor in the presence of anesthetic gases such as Halothane, the oxygen reading may fall (see Table below). The magnitude of this error will depend upon the level of oxygen and the duration of exposure.

The anesthetic agents listed in the following table (Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane) were vaporized into a stream of 30% oxygen / 70% nitrous oxide, and the resulting drops in oxygen level after an exposure of approximately two hours were noted.

Exposures in excess of two hours may produce slightly greater errors. The errors listed are typical for all oxygen sensors such as the R17MED. Exposing the sensor to air or gases that do not contain anesthetic agents for a period of time equal to or greater than the exposure interval will eliminate the reading error in most cases.

Table 3-1: Oxygen Reading Error in a Mixture of Anesthetic Gas

Gas or Vapor Level (Balance: Mixture of 30% O_2 / 70% N_2O, except where noted)		
Gas or Vapor	**Test Level**	**Oxygen Reading Error**
Helium	50%, balance O_2	0%
Nitrous Oxide	80%, balance O_2	0%
Carbon Dioxide	10%, balance O_2	0%
Halothane	4%	< 1.5% O_2 *
Enflurane	5%	< 1.5% O_2 *
Isoflurane	5%	< 1.5% O_2 *
Sevoflurane	5%	< 1.5% O_2 *
Desflurane	15%	< 1.5% O_2 *

* Errors are approximate and may vary based on exposure times and concentrations.
These performances meet or exceed the requirements of ISO 7767: 1997 (E).

CAUTION: THE AX300-I SHOULD NOT BE USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS SUCH AS DIETHYL ETHER OR CYCLOPROPANE.

CAUTION: THE AX300-I, OXYGEN SENSOR AND ASSOCIATED HARDWARE ARE NON-STERILE DEVICES. DO NOT AUTOCLAVE THE INSTRUMENT OR SENSOR, AS THIS WILL DAMAGE THE EQUIPMENT.

3.6.5.2 CARE AFTER USE IN NITROUS OXIDE

CAUTION: THE R17MED SENSOR SHOULD NOT BE LEFT IN NITROUS OXIDE MIXTURES ANY LONGER THAN ABSOLUTELY NECESSARY.

After exposure to nitrous oxide mixtures, the sensor should be left in 100% oxygen overnight (e.g., left in a breathing circuit that has been flushed with pure oxygen). If this is not practical, when using the tee, remove the plastic flow diverter and leave the sensor in room air. If the oxygen reading continues to drop after each use in nitrous oxide the sensor should be removed from service. If the sensor can no longer be calibrated or if there is any sign of electrolyte leakage, the sensor should be disposed of in accordance with local regulations and the Material Safety Data Sheet (MSDS).

Note: The MSDS on this material is available upon request through the Teledyne Environmental, Health and Safety Coordinator. Contact at (626) 934-1592

3.7 Troubleshooting

The AX300-I oxygen analyzer provides a variety of built-in safety features that prevent its use when a fault is detected. When a unit displays the message √ SENSOR and sounds the audible and visual alarm continuously, it is an indication of a faulty connection between the sensor and the unit or an expired or faulty sensor. To determine where the difficulty lies, refer to the following guidelines in Table 3-2.

Table 3-2 Troubleshooting

Symptom	Why	What To Do
New sensor responds slow or drifts.	If the sensor is new and was just removed from its sealed bag it may need to run for several hours.	A) Wait 1–2 hours and recalibrate.
Sensor will not read below 22 % after calibration in 100% O2.	Calibration in 100% was invalid or the room air is contaminated with excess oxygen.	A) Recalibrate using dry gas making sure the reading stabilizes before making any adjustments. B) Make sure that at least 6" (30 cm.) of tubing is attached to the exhaust side of the tee adapter to prevent back filling. O2 flow rate should not exceed 5 l/min. C) Oxygen concentration at the sensor is significantly higher than 21%. Take the instrument to a well-ventilated area and check the reading again. D) Try calibrating with a known good sensor; if this fails, see symptom "Reading drifts over 2–3%..."
The sensor does not react to changes in oxygen concentration, or the readings are unstable and drifting.	Water is condensing on the sensing surface. Electrical interference is disrupting the electronics	A) Remove the sensor from tee adapter and unscrew the plastic flow diverter. Using absorbent tissue or cotton swab, gently wipe off sensing surface inside threaded portion of sensor assembly. B) Relocate unit away from sources of electrical noise such as cauterizing equipment and two-way radios.
The display is flashing √ SENSOR	The unit has detected a fault in the signal from the sensor. Sensor has expired.	A) Check sensor cable connections and make sure they are completely inserted into the mating connector with the capture

	The sensor has been exposed to a gas containing little or no oxygen.	nut firmly in place. B) Expose the sensor in 100% O2 and check calibration. C) The sensor output has fallen to a level where it is no longer usable. Replace sensor.
The oxygen reading fluctuates or appears to be incorrect.	Like all O2 sensors, the R17MED detects the changes in the partial pressure of O2.	A) During calibration, make sure there is no restrictions on exhaust side of sensor. If the reading changes with flow, the sensor is pressurized or there may be a leak in the system. B) If a high degree of accuracy is desired, or the concentration of O2 is in excess of 40%, calibration with 100% is recommended. C) If humidified gas is used to ventilate the patient, water vapor actually dilutes the gas. See Appendix: Humidity, Temperature. D) If a blender is used, check its calibration. See Appendix: Discrepancy in Readings.
The unit has stopped working and the LCD is displaying alphanumeric figures.	The AX300-I unit is equipped with an electronic "watch dog," which analyzers the circuitry within the unit for potential faults and renders the unit inoperable until the condition is corrected. (See Watch dog section below) Several conditions can activate the "watch dog." Dropping the unit, poor battery connections, and radio frequency interference are the most common	A) Disconnect the batteries and inspect the contacts for corrosion. Reconnect the batteries. If the unit functions properly, calibrate the unit and reset the alarm values. B) Try a new set of batteries. C) Increase the distance between the unit and any source of radio frequency interference. The sensor cable is a prime source of pickup as it can act like an antenna. Relocate the sensor cable and if possible change its coiled length to “de-tune” its antenna effect. Placing the cable in a

	causes. See the watch dog section for additional information	different position may also help.
No display.	A) Batteries expired. B) Bad battery connection.	A) Check/replace batteries. B) Check battery connections. C) Calibrate.
Keys inoperable/cannot turn unit off	The LOCK/UNLOCK key is activated which is preventing key operation	A) Press LOCK/UNLOCK key once. LCD will flash indicating keys are active.
Cannot adjust calibration	Critical settings require two keys be pressed in a specific order. LOCK/UNLOCK key is active	A) If display is not flashing press lock key once to activate keys. Press desired function followed by the Up and Down key.

Note: In the event that none of these procedures produce desired results, remove the batteries and return the unit to Teledyne for repair.

3.8 Watchdog

The AX300-I is equipped with a watchdog circuit that continuously analyzes the electronics for proper operation. If the watchdog detects a failure, one of the following codes will appear on the LCD.

The error codes can appear on the LCD when batteries are first installed, during normal operation or if the unit is subjected to extreme shock. In some cases an additional digit is used in the error code to supply additional information. For example, the error code 6 and 7 are followed by another digit listed as (N) in Table 3.3. The error code 65 would indicate that a key is stuck and this key is the Silence key.

In addition to supplying visual error codes, the audio device will beep a number of times to indicate the general error in case the display is not functional.

Note: To reset the watchdog error code. Remove one battery for 5 seconds and replace. If the error persists contact your locale representative or Teledyne for assistance.

Table 3-3 Error Codes

Error Code	Audio Beeps	Error
Indeterminate	2	The watchdog timer has timed out indicating a serious software error
30	3	Analog output is different from the expected value. May indicate a shorted or over-loaded analog output or a failure of the analog to digital converter or digital to analog converter circuit.
50	5	The ADC circuit failed during POST.
6 (5)	6 (There is no indication of which key is stuck)	A stuck key has been detected. The second digit example (5) on the display shows which key is stuck: 1 - Batt 2 - Cal 5 - Silence 8 - Key Lock
7(2)	7 (There is no indication of the type of DAC failure)	A failure has occurred during the automatic calibration of the digital to analog converter (DAC) circuit. The second digit example (2) shows the type of digital to analog failure. 0 - Measurement 1 - High Test 2 - Low Test 3 - Offset Cal 4 - Gain Cal

3.9 Other Problems with the Instrument

Most other problems arise from either mechanical damage from the instrument falling from a bench or table, or electronic component failure. In these units, repair or troubleshooting the PCB or individual component on the board is not feasible. It requires specialized test equipment and probes not generally available to the public. Under most circumstances a replacement of the entire PC Board is recommended. The instrument must be returned to the factory for PCB installation.

Occasionally, depending on the environment of use, keys can become stuck or function erratically due to contamination. Use a mild non-abrasive cleaner solution to periodically clean the keypad and screen. An aerosol jet spray of the type commonly used to clean computer keyboards can be used to dislodge dirt and accumulations from the keypad.

The Error Code Table (Table 3-3) includes a description of certain fault codes, which are diagnostic of some common (usually electronic) problem with the instrument. Some of these codes refer to specific components on the PCB that are problematic or have failed. These codes are useful in reporting a problem with your instrument to Teledyne Customer Service. If an error code is indicated on your analyzer record the number and report it to the Customer Service Department at the address below.

3.10 Return Authorization for Service

For any service beyond sensor and battery replacement, the instrument must be returned to the factory. A return merchandise authorization (RMA) number must be obtained from Teledyne Analytical Instruments prior to returning an instrument for service. You can request a RMA number via email by contacting us at:

tetci_customerservice@teledyne.com

You can also contact us at the address below.

Customer Service Department
TELEDYNE Analytical Instruments

16830 Chestnut Street
City of Industry, CA 91749-1580 USA

Phone (626) 934-1500, Fax (626) 961-2538
Or via the web at: www.teledyne-ai.com

Viamed Limited is our EC Designated representative to comply with MDD 93/42/EEC responsibilities. For items supplied in the UK, address and Contact details as follows:

Viamed Ltd
15 Station Road,
Cross Hills,
Keighley,
West Yorkshire,
BD20 7DT

Tel: +44(0) 1535 634542
Fax: +44(0) 1535 635582
Email: info@viamed.co.uk

Appendix

A.1 Specifications

Range:	0-100% oxygen
Accuracy:	±2% of full scale (at constant temperature and pressure)
Response Time:	90% in less than 8 seconds at 25 °C
Battery Life:	Approximately 2000 hr. continuous use in a non-alarm condition
System Power:	3 AA alkaline batteries.
Sensor Type:	Class R17MED
Expected Life:	36 months in air. (10 months when continuously exposed to 100% oxygen)
Dimensions:	2.5" W × 1.25" D × 4.5" H (66 mm x 33-mm × 111.5 mm)
Sensor Cable:	Retracted: 2 ft / Extended: 10 ft.
Storage Temp.	10-30 °C (continuous), 5-50 °C (Intermittent)
Operating Temp:	0-40 °C

A.2 Spare Parts List

QTY	PART NO	DESCRIPTION
1	C43690-R17MED	Micro-Fuel Cell R17MED with flow diverter P/N A50057
3	B99	"AA" size alkaline battery
1	C-74721	Cable assembly
1	A268	Tee adapter (22 mm)
1	B-74543-B	Front panel assembly (AX300-I)
1	D-74459	Back panel
1	C-74461	Battery door
1	B-74462	Battery door lock
1	B-74463	Mounting clip
1	B-74466	Base assembly

A.3 Optional Accessories

1	A50057	R17MED flow diverter
1	CP2345	Universal Pole Mounting Clamp
1	CP2344	"V" mount Pole Clamp
1	B647	"V" mount Wall Adapter
1	A51589	Sensor adapter cap, female (22 mm)
1	A51588	Sensor adapter cap, male (22 mm)
1	C53790	Calibration assembly
1	A284	Universal adapter set for pediatric circuits (15mm)
1	A274	Tee adapter, autoclavable
1	A283	Tee adapter, metal
1	B-75554	0-1 VDC Interface Cable
1	B-75555	RS 232 Interface Cable

Schematics are available on request.

A minimum charge is applicable to spare parts orders.

Note: Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.

Orders should be sent to:

TELEDYNE Analytical Instruments

16830 Chestnut Street
City of Industry, CA 91749-1580

Phone (626) 934-1500, Fax (626) 961-2538
Web: www.teledyne-ai.com

or your local representative.

Viamed Limited is our EC Designated representative to comply with MDD 93/42/EEC responsibilities. For items supplied in the UK, address and Contact details as follows:

Viamed Ltd
15 Station Road,
Cross Hills,
Keighley,
West Yorkshire,
BD20 7DT

Tel: +44(0) 1535 634542
Fax: +44(0) 1535 635582
Email: info@viamed.co.uk

BLANK

Index

accessories, 46
accuracy, 45
address, 43, 47
ALARM SILENCE button, 10, 13, 15
amplification, 13
analog output, 22
analysis range, 10, 45
anesthetic gas, 27, 37
anode, 12
audio alarm, 13
bar graph indicator, 20
batteries, 10, 19
battery compartment, 19
battery installation, 19
battery life indicator, 34
battery status indicator, 9
breathing circuits, 24
cable, 16
calibration, 20, 21, 34
calibration interval, 26, 34, 36
cathode, 12
CHECK SENSOR button, 10, 12, 38
Cidex, 29
cleaning, 29
confined volumes, 24
copyright, 2
current output. *See* output
diffusion sampling, 17
digital output, 23
dilution effects, 25, 35
discrepancy in oxygen reading, 36
disinfecting, 29
display, 9
diverter, 12, 17, 24, 28, 38
drift, 26, 35
electrolyte, 12
error, 27, 28, 37
error code, 41, 42
ethylene oxide, 29
FCC, 2
features, 10
front panel AX300, 9
galvanic cell, 12
humidity, 25, 35
improper calibration, 34
intended use warning, 4
isopropyl alcohol, 33
jumper, 23
linear, 10, 22
LOCK/UNLOCK button, 15
maintenance, 33
moisture, 25, 35
mounting bracket, 15
nebulizer, 25, 35
nitrous oxide, 28, 38
optional accessories. *See* accessories
output, 12
output port, 23
oxygen sensor, 12
partial pressure, 26, 35
power, 15
power requirements, 10, 45
R17MED, 10, 12, 24, 28, 34, 38
reading discrepancy, 26, 36
reading error, 26, 27, 35, 37
rear panel, 18
reconfiguring output, 23
resetting alarms, 10
response, 45
restriction on selling. *See* sale restriction
return merchandise authorization. *See* RMA
RMA, 33, 43
safety information, 4
sale restriction, 2
sensor, 10, 12
sensor cable, 45
sensor failure alarm, 10
sensor life, 45
sensor maintenance, 34
sensor mounting, 17
set up, 15
signal output, 22
signal processing, 13
signal processor, 12

spare parts listing, 46
specifications, 45
stand, 15
standards, 10
sterilizing, 29
storage, 34
surface mount technology, 33
tee adapter, 24
Teledyne address, 43, 47
temperature, 25, 35
temperature tracking, 26, 35
thermal equilibrium, 26, 35
thermal tracking error, 26, 35
thermistor, 25, 35
troubleshooting, 38
type B equipment, 1
ventilator, 26, 36
warranty, 2
watchdog circuit, 41
water vapor, 22
website address, 43, 44, 47